DPM™ 1

Pulse Oximeter

Service Manual

mindray

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WARNING

- **Federal Law (USA) restricts this device to sale by or on the order of a physician.**

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1. Return authorization.

Contact the Customer Service Department and obtain a Customer Service Authorization number. This number must appear on the outside of the shipping container. Returned shipments will not be accepted if the number is not clearly visible. Please provide the model number, serial number, and a brief description of the reason for return.

2. Freight policy

The customer is responsible for freight charges when this product is shipped to Mindray DS for service (this includes customs charges).

3. Return address

Please send the part(s) or equipment to the address offered by the Customer Service Department.

Contact Information

Manufacturer:	Mindray DS USA, Inc.
Address:	800 MacArthur Blvd.Mahwah, New Jersey 07430 USA
Tel:	1.800.288.2121, 1.201.995.8000
Website:	www.mindray.com

Safety Precautions

1 . Meaning of Signal Words

In this manual, the signal words **WARNING** and **CAUTION** are used regarding safety and other important instructions. The signal words and their meanings are defined as follows. Please understand their meanings clearly before reading this manual.

Signal word	Meaning
⚠**WARNING**	**Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**
⚠**CAUTION**	**Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.

2 . Meaning of Safety Symbols

Symbol	Description
	Type-BF applied part
	"Attention" (Refer to the operation manual.)

3 . Safety Precautions

Please observe the following precautions to ensure the safety of service engineers as well as operators when using this system.

⚠WARNING: **Do not connect this system to outlets with the same circuit breakers and fuses that control current to devices such as life-support systems. If this system malfunctions and generates an overcurrent, or when there is an instantaneous current at power ON, the circuit breakers and fuses of the building's supply circuit may be tripped.**
Do not use flammable gasses such as anesthetics, or flammable liquids such as ethanol, near this product, because there is danger of explosion.

⚠CAUTION:

1. **Malfunctions due to radio waves**

   (1) Use of radio-wave-emitting devices in the proximity of this kind of medical electronic system may interfere with its operation. Do not bring or use devices which generate radio waves, such as cellular telephones, transceivers, and radio controlled toys, in the room where the system is installed.

   (2) If a user brings a device which generates radio waves near the system, they must be instructed to immediately turn OFF the device. This is necessary to ensure the proper operation of the system.

2. **Do not allow fluids such as water to contact the system or peripheral devices. Electric shock may result.**

Content

Chapter 1 Introduction....1-1

1.1 General....1-1

1.2 Functions....1-1

1.3 Parameters Measurement....1-1

Chapter 2 Circuit Principle....2-1

2.1 Overview....2-1

2.2 Reliability Design....2-7

2.3 EMC Design....2-8

Chapter 3 Specifications....3-1

3.1 General....3-1

3.2 Parameter Specifications....3-1

3.3 Display and Control....3-1

3.4 Input/Output Communications....3-2

3.5 Electrical specifications....3-2

3.6 Printing....3-2

3.7 Physical Characteristics....3-3

3.8 Environment and Safety....3-3

3.9 EMC....3-4

Chapter 4 Structure....4-1

4.1 Explosive Diagram....4-1

4.2 Batteries Installation and Maintenance....4-2

Chapter 5 Test and Prompt List....5-1

5.1 Test Procedure....5-1

5.2 Prompt List....5-2

Chapter 6 Maintenance and Cleaning....6-1

6.1 Maintenance....6-1

6.2 Cleaning....6-1

6.3 Disinfection & Sterilization.....6-2

6.4 Technical Support.....6-2

Chapter 1 Introduction

1.1 General

The DPM1 Pulse Oximeter is a non-invasive, spot-check, oxygen saturation and pulse rate monitor. It operates only on battery power using existing DPM1 disposable and reusable finger and ear sensors labeled for patients ranging from neonates to adults.

Parameters monitored by the DPM1 pulse oximeter include: arterial oxygen saturation (SpO_2), pulse rate (PR) and pulse strength. The DPM1 pulse oximeter employs a finger SpO_2 sensor to measure patient's SpO_2, PR and pulse strength, and all of these are displayed on the LCD screen.

The DPM1is operated and controlled by three buttons, which are Power Button, Backlight Button and ID Confirm Button. The DPM1 oximter is also capable of data manage and exporting the patient's trend data to a PC for printing through the SpO2/communication multiplex port.

1.2 Functions

DPM1 has the functions shown as below：

1. Monitoring-----SpO_2, PR and pulse strength.
2. Printing-----patient ID, trend data, measurement time.
3. Power Saving------automatic standby, automatic shutdown.
4. Warning-----memory full, ID full, low battery, standby, technical error.

Printing is available only when the device is equipped with a communication cable and works with a PC with a printer.

1.3 Parameters Measurement

Parameters monitored by DPM1 pulse oximeter includes: SpO_2, PR and pulse strength.

DPM1measures SpO_2 by pulsating oximetry, which is a continuous and non-invasive method to determine oxygen saturation of hemoglobin.

DPM1 also can determine pulse rate and pulse strength, which are indicated on the LCD screen after processing.

For Your Notes

Chapter 2 Circuit Principle

2.1 Overview

The DPM1 pulse oximeter collects SpO2 data from the sensor and sends to mainboard. The maniboard processes the data and displays the results (SpO2 values) on the LCD screen. Pulse-strength bar, battery remained capacity and data export indication are also shown on the screen. DPM1 can be connected with PC through serial port for data transportation and the data can be printed out from PC.

2.1.1 Hardware Theory

DPM1's mainboard consists of power circuit, main logic circuit, display circuit and control input circuit. The SpO2 value can be displayed on the LCD or be exported to PC through serial port. The data also can be saved in the EEPROM on the main board as history record. Watchdog circuit is used to reduce interference. Low-power design is adapted to the main board in order to saving energy.

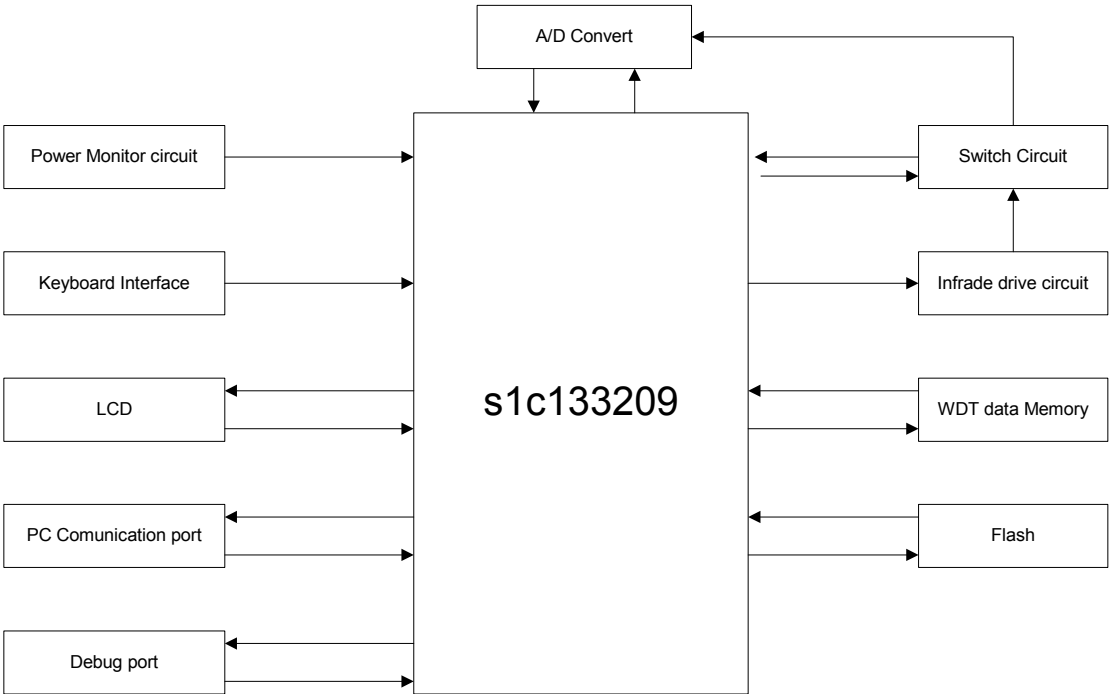

Fig 2-1 DPM1 Pulse oximeter Block Diagram

2.1.1.1 CPU Power System

S1C33209 uses two voltages. VDD is used to supply the CPU and VDDE is the power

supply for IO module and analog circuit. The voltage of them is 3.3V.

S1C33209 has two crystal oscillators, OSC1 and OSC3. OSC1 supplies RTC and system clock frequency, whose frequency is 32.768KHz. OSC3 supplies work frequency to the CPU, whose frequency is 22.1184MHz.

2.1.1.2 Watchdog Circuit

The watchdog circuit control chip is MAX823. When S2 is shorted, the program will access watchdog procedure. R64 and C63 compose RC low-pass filter to reduce interference of the reset signal. R87 is a pull-up resistor. When power on or operate reset by manual, the capacitor of C54 will release its charge and become low level voltage. C54 and R59 form a RC low pass filter to reduce high frequency noise.

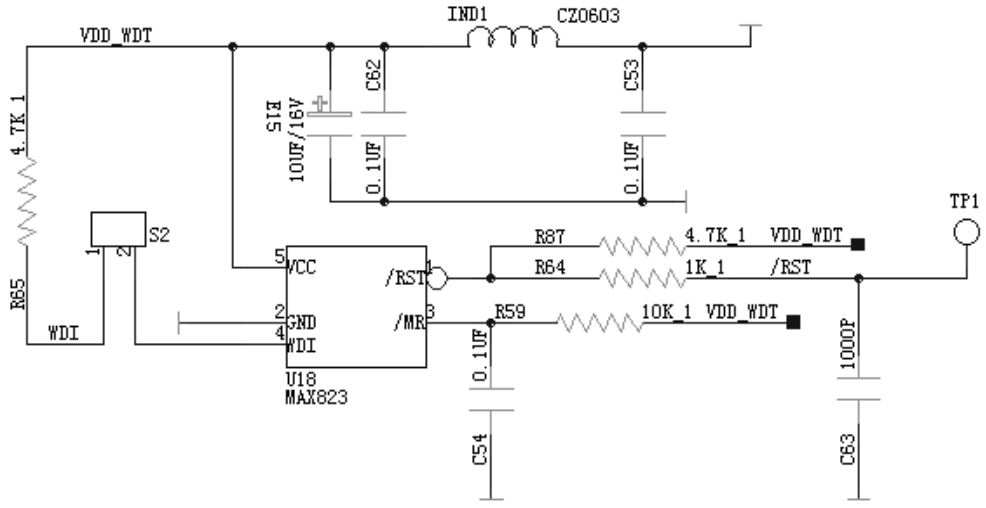

Fig 2-2 Watchdog Circuit

2.1.1.3 Data Storage

The DPM1 requires automatic data storage in case of power supply failure. 24WC64 IC with the capacity of 8K bytes was adopted. This IC uses I^2C bus.

The C111 and C112 act as filter capacitors to reduce the influence from high frequency noise. When the 24WC64's seventh pin is high level voltage, the IC is write-protected. C113 is a filter capacitor between the write-protect pin and VDD pin. It is used to set the write-protect pin to high level voltage to avoid wrong write operation. The circuit block is shown as below:

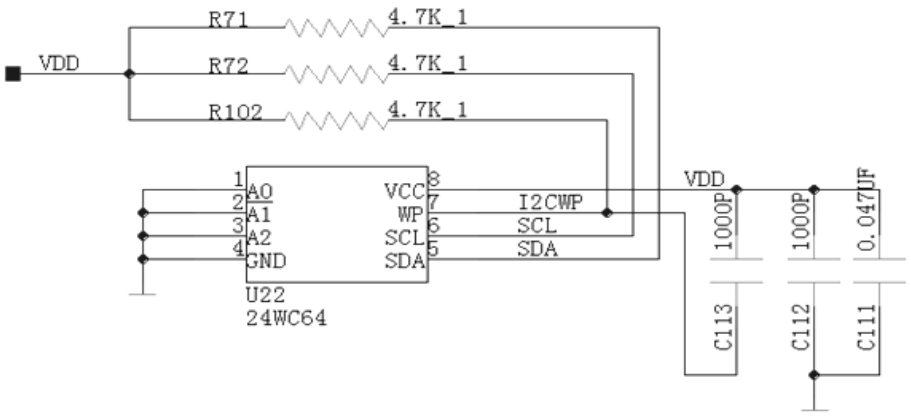

Fig 2-3 Data Storage Circuit

2.1.1.4 DAC

DPM1's analog circuit includes two DAC channels. They are DRIVE channel and OFFSET channel.

MAX5102A is a 8-bit resolution DAC control chip. The 2.5V reference level was produced by MAX6066.

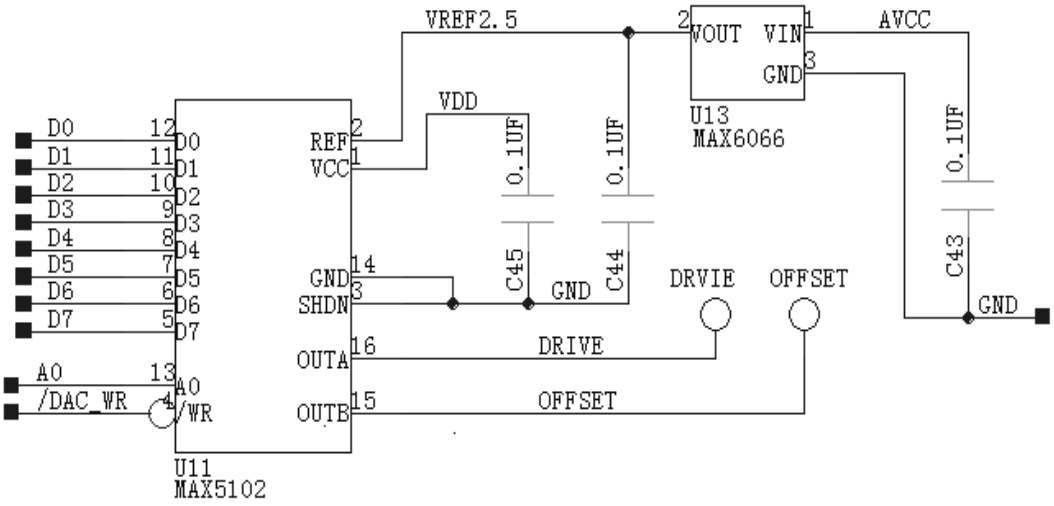

Fig 2-4 DA Circuit

2.1.1.5 ADC

DPM1 uses MAX1290 as the ADC, which of 12-bit resolution and 8 channels and parallel interface. Two signals of SIGNAL and PROBE-DET are collected by the chip. They directly enter the channel 0 and channel 1 of the ADC without analog switch.

MAX1290 uses separate power supply and the input signal should be in the range of 0V~5V. But the amplitude of the SpO2 signal is between -2.5V and +2.5V. Therefore, a

2.5V voltage shift should be required. R27-C20, R20-C30 and R23-C19 form RC low pass filters to reduce the interference from high frequency noise. C31 is used to prevent self-oscillating and enhance the reliability.

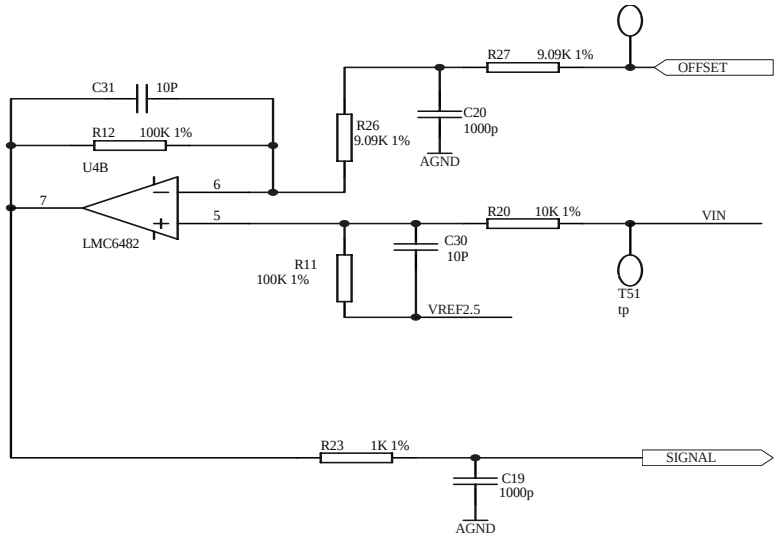

Fig 2-5 Voltage Shift Circuit

Due to the input signal limits of 0V~5V for the ADC chip, a clamp diode is used at the SIGNAL input circuit.

2.1.1.6 LCD Display Module

DPM1 uses LCD module to display data and patient information. The interface between LCD and CPU includes power line, data bus, read/write control, chip selection and address line.

Backlight of the LCD is separated from others, which is a LED and controlled by a CPU-controlled transistor or MOS transistor.

A π-type filter was adopted for this power in order to reduce the interference from the voltage multiplier circuit in the LCD module.

2.1.1.7 Switch ON/OFF Delay Circuit

DPM1 has no delay for switch on, but there is 2s delay for switch off.

In the delay circuit, a voltage of +7V is slowly supply to the Q5. The RC network on Q4's base is used to eliminate the button-press shaking and to protect the circuit from electrostatic charge. Before power on, Q5 is off and does not influence Q4. When the Vbe of Q5 goes up and over 0.7V, the Q5 will work. Additionally, the capacitance of E104 should be large enough, otherwise the time interval between 0V and 0.7V will be short. When power off, the discharge time of the 10uF capacitor will become short because the diode D7 is used to fasten the charge release. After power on, Q5 is on and the base of Q4 is 0V. When a button is pressed, Q4 is off and RST-POWER will not function. D2 and

R85 work together to prevent the locking of the CPU.

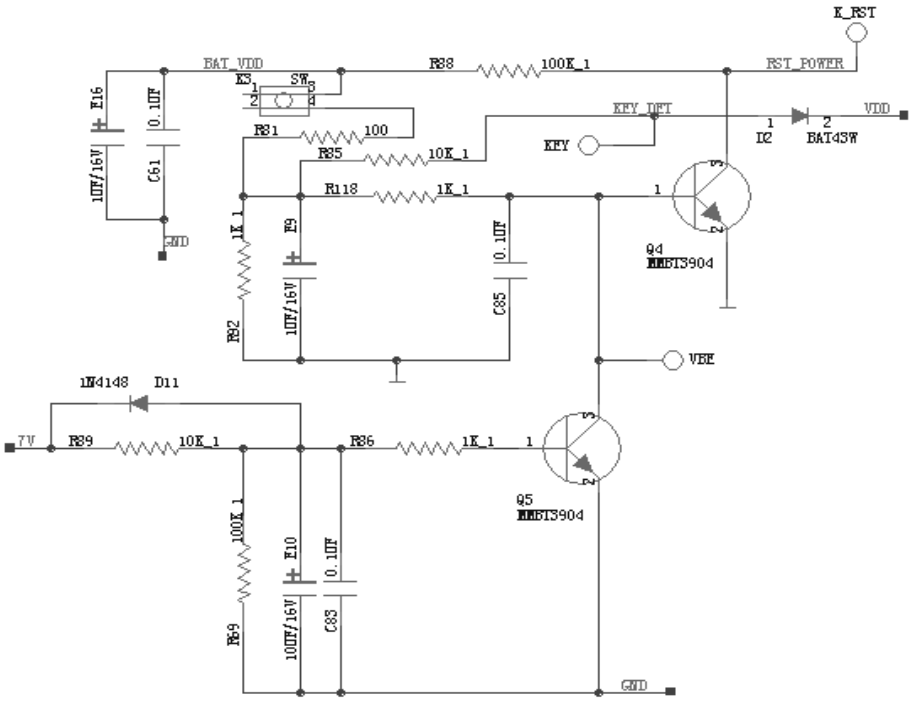

Fig 2-6 Delay Circuit Block

The power-on and power-off signals through two diodes constitute a AND logic output signal named PCON signal, which directly controls the ON/OFF. Resistor R111 is necessary for the AND logic circuit. R95, C82 and E12 form a RC filtering network to protect the circuit from electrostatic charge.

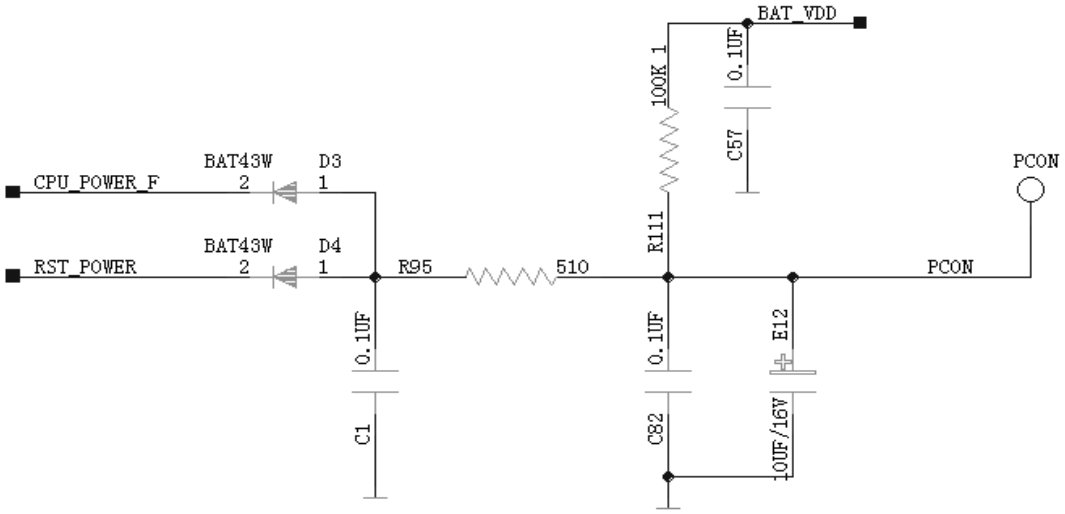

Fig 2-7 Switch On Circuit

2.1.1.8 Serial Port Signal Voltage Level Conversion Circuit

MAX202E is used for the signal voltage level conversion. The output of MAX202E is 5V TTL voltage, and the S1C33209's I/O should use 74HC32 as the voltage level convertor and driver and isolator. R116 and R115 convert the TTL level to LVTTL. R61 and R116 can prevent short-circuit and electrostatic charge damage. Circuit block is shown as below:

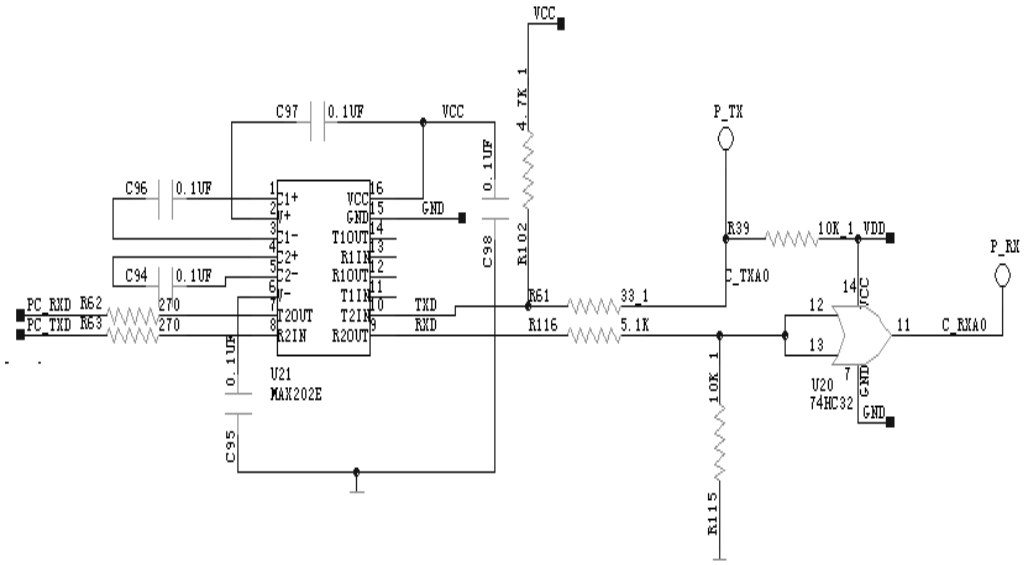

Fig 2-8 Serial Signal Voltage Level Conversion Circuit

2.1.1.9 Button Circuit

DPM1 has three buttons, Power Button, ID Confirm Button and LCD Backlight Button. The circuit is shown as below:

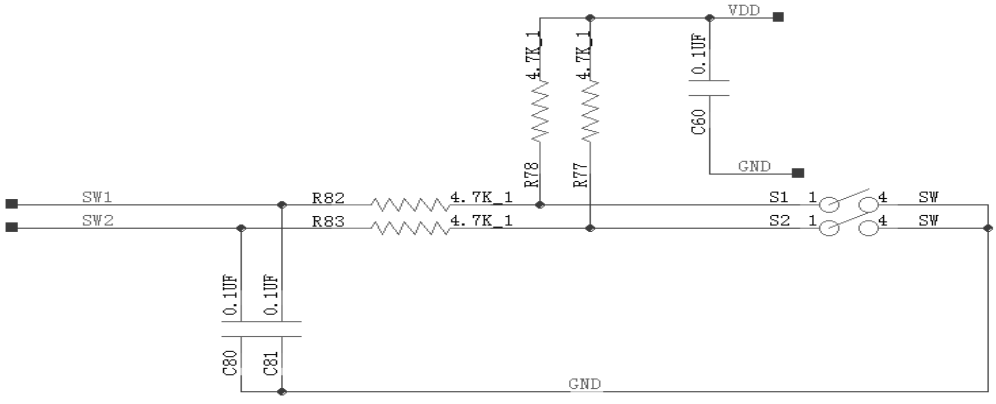

Fig 2-9 Button Circuit

R82 and C81 form RC filter circuit and can resist electrostatic charge interference. The resistance of R82 is 4.7K, which can protect the circuit with big current. RC circuit can also reduce the shaking influence.

2.1.1.10 Voltage Detect

DPM1 requires that the battery voltage and +7V be detected all the time. S1C33209 has 8 10-bit AD channels, two of which were used. S1C33209 cannot stand that high voltage, so, a voltage divider was adopted to convert the monitored voltages to the range S1C33209 can detect. The divided voltage has a RC filter, which can resist the influence from electrostatic charge.

2.1.2 Power Supply Circuit Block Diagram

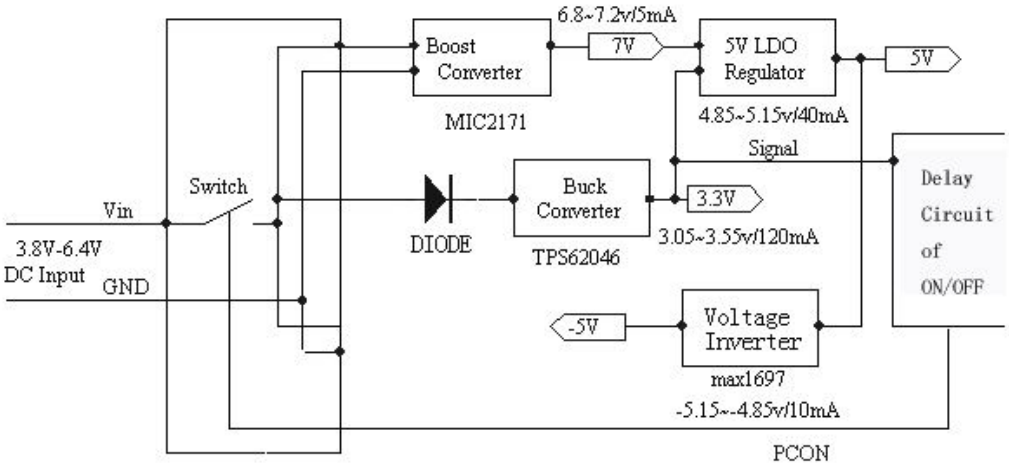

Fig 2-10 Power Supply Circuit Block Diagram

2.2 Reliability Design

The following reliability control methods are used in the DPM1:

1. Derating for key elements;
2. Watchdog circuit, to restore the system when the software crashes;
3. By-pass capacitors for each IC, to reduce the interference from power supply;
4. Serial resistors on each line of the serial port, to avoid the destroy to devices due to unintentional short with power;
5. One I/O port to control the write protection of the FLASH, to reduce the possibility of unintentional FLASH write;
6. Monitoring the two major voltages through the CPU's AD, to prevent inaccurate measurement and unreliable data due to the voltage swing.

2.3 EMC Design

The following protections are used for EMC design in DPM1:

1. Every IC has one by-pass capacitor, some ICs have different rating capacitors to enlarge the filter band;
2. Serial resistors on the communication lines connected with the PC, to reduce the interference propagation;
3. RC low pass filter on most low frequency signals, to reduce high frequency interference;
4. One ground plane, no discrimination between digital ground and analog ground;
5. Match resistor used on important signals, e.g. read/write, chip select etc., to prevent oscillating or overshoot

Chapter 3 Specifications

3.1. General	
3.1.1 Basics	
Product Model:	DPM1
Product Name:	Pulse Oximeter
Classification:	IIb (According to MDD 93/42EEC directive) II (21CFR 870.2700, 870.2710)
3.1.2 Safety Designations	
Safety designations per IEC 60601-1 Standard:	
Type of protection against electric shock:	Internally powered equipment.
Degree of protection against electric shock:	Type BF
Mode of operation:	Continuous
Protection Against Ingress of Liquid's:	Not protected (Ordinary) - IPX0 per IEC60529
3.2. Parameter Specifications	
3.2.1 SpO_2	
Range:	0% to 100%
Resolution:	1%
Accuracy:	70% to 100%:±2% (Adult, Pediatric) 70% to 100%:±3% (Neonate) 0% to 69%: Unspecified
3.2.2 PR	
Range:	25 to 254bpm
Resolution:	1bpm
Accuracy:	±2bpm
3.3. Display and Control	
3.3.1 Display	
Display Type:	Matrix LCD
Display Area:	Not less than 42mm×35mm.
Back Light:	Blue
Display Information:	SpO2, PR, Pulse strength, ID number, Memory Full, ID Full, Low battery, Standby, Communication, Technical error
3.3.2 Buttons	
Power Button:	Switches on/off the oximeter. The power-on is not delayed and the

	power-off has a 2 second delay.
Backlight button:	Switches on/off the backlight
ID Confirm button:	Confirms whether use the previous ID for the new measurement.
Backlight button + ID Confirm button	Deletes data
3.3.3 Power Saving Features	
The oximeter enters the standby mode if the finger slips off the sensor, or the sensor becomes disconnected from the oximeter. In the standby mode, if the sensor detects a finger, the oximeter automatically resumes the normal operation mode; if no finger is detected within 5 minutes, the oximeter automatically shuts down.	
3.4. Input/Output Communications	
The oximeter meets the requirements of IEC60601-1 for short-circuit protection and leakage current. The oximeter provides only one input/output interface, which connects either the SpO_2 sensor or the communication cable.	
3.4.1 Connecting the SpO_2 sensor	
The interface is capable of connecting the 9-pin D connector used by the MINDRAY DS SpO_2 sensor adaptor. The interface is designed so that common DB9 connected cannot be plugged in.	
3.4.2 Connecting the communication cable	
The interface is capable of connecting the Mindray DS serial communication cable, through which the oximeter can be connected to a host computer for printing or upgrading. The Mindray DS -designed communication software must be installed on the host computer before the communication can be done. Common serial communication cable cannot be connected to the interface.	
3.5. Electrical specifications	
Working Voltage:	4.0 to 6.4 VDC
Power Supply:	Batteries
Battery Specifications:	Four Common 1.5V AA alkaline or rechargeable batteries
Shutdown Leakage Current:	< 200uA
Battery Run Time:	15-hour continuous operation with alkaline batteries
Power Consumption	720mW
3.6. Printing	
Printer	The PC's printer
Paper:	A4
Content:	ID data and trend data
The data stored in the DPM1 Pulse Oximeter can be exported to a computer through a communication cable, and then printed out by the printer connected with the computer.	

3.7. Physical Characteristics	
Maximum Size:	65×140×32mm (W×H×D)
Maximum Weight:	130g (not include battery and sensor)
3.8. Environment and Safety	
Temperature	
Operation:	0°C to 50°C
Transportation and storage:	-20°C to 60°C
Humidity	
Operation:	15% to 95%（noncondensing）
Transportation and storage:	10% to 95%（noncondensing）
Altitude (above sea level)	
Operation:	-500 to 4,600 m (-1,600 to 15,000 feet)
Transportation and storage:	-500 to13, 100 m (-1,600 to 43, 000 feet)
Transportation	
While packaged as designed, the oximeter meets the 1A requirements of the ISTA transportation test procedure (for the goods to be transported in a container). The required temperature, humidity and altitude must appear on the carton.	
Shock	
The oximeter shall be exposed a half sinusoidal pulse that is 15g and 11ms, as required by IEC 68-2-27. After the test, the oximeter meets all the specifications.	
Vibration	
After being subjected to sinusoidal or random vibration (see FDA Reviewer Guidance for Pre-market Notification Submission, November 1993 - draft), the oximeter meets all the specifications.	
Sinusoidal vibration:	As required by IEC 68-2-6 1g or 0.07mm, 57-62 Hz crossover frequency 10 - 500Hz, 10 sweep cycles for every axis.
Random vibration:	As required by IEC 68-2-37. 0.02 g2/Hz 20 - 500 Hz Low reproducibility. 9 minutes for every axis.
Falling:	The oximeter meets the requirements of IEC 60601-1, clause 21.6 and of ECRI PB-296 892, AIII 3.3 (the part against Class III instruments).
Impact:	The oximeter meets the requirements of ECRI PB-296 892, AIII 3.2 (the part against Class III instruments).

Spillage and ingress of liquid:	The oximeter meets the requirements of IEC 60601-1-1, clause 44.3 and of IEC 60601-27, clauses 30 and 34. It shall also meet the IEC 529 requirements for IPX0 devices.
Surface temperature:	The oximeter meets the requirements of IEC 60601-1, clauses 42.1，42.2 and 42.3. The oximeter meets the requirements of FDA Reviewer Guidance for Premarket Notification Submission, November 1993, paragraph i7.
Mechanical stability:	The oximeter meets the requirements of IEC 60601-1, clause 24.1.
Incompatibility with external connectors	The oximeter meets the requirements of IEC 60601-1, clause 56.3 and of FDA Reviewer Guidance for Premarket Notification Submission November1993, i2.
Enclosure rigidity and strength	The oximeter meets the requirements of IEC 60601-1, clause 21a，16a and 21b. The oximeter meets the requirements of UL 2601-1, clause 55.
Deterioration of heat radiation conditions	The oximeter meets the requirements of IEC 60601-1, clause 52.5.5.
Leakage current	The oximeter meets the requirements of IEC 60601-1/EN 60601-1, Clause 19.
Dielectric strength	The oximeter meets the requirements of IEC 60601-1/EN 60601-1, Clause 20.
3.9 EMC	
The oximeter shall meet the requirements of IEC 60601-1-2.	
Radiated emission	The oximeter meets the requirements of CISPR 11 （EN 55011:1998） Group 1, Class A.
Conducted emission	The oximeter meets the requirements of IEC 61000-4-6, Level 2, 150KHz to 80MHz, $3V_{rms}$, 80% AM @ modulation frequency significant for the equipment under test
Immunity to radiated RF electromagnetic fields	The oximeter meets the requirements of IEC 61000-4-3, 80MHz to 2.5GHz, 3V/m, 80% AM @ 2 Hz or modulation frequency significant for the equipment under test.
ESD	The oximeter meets the requirements of IEC 61000-4-2.
Immunity to Power frequency magnetic fields	The oximeter meets the requirementsIEC 61000-4-8.

Chapter 4 Structure

4.1 Explosive diagram

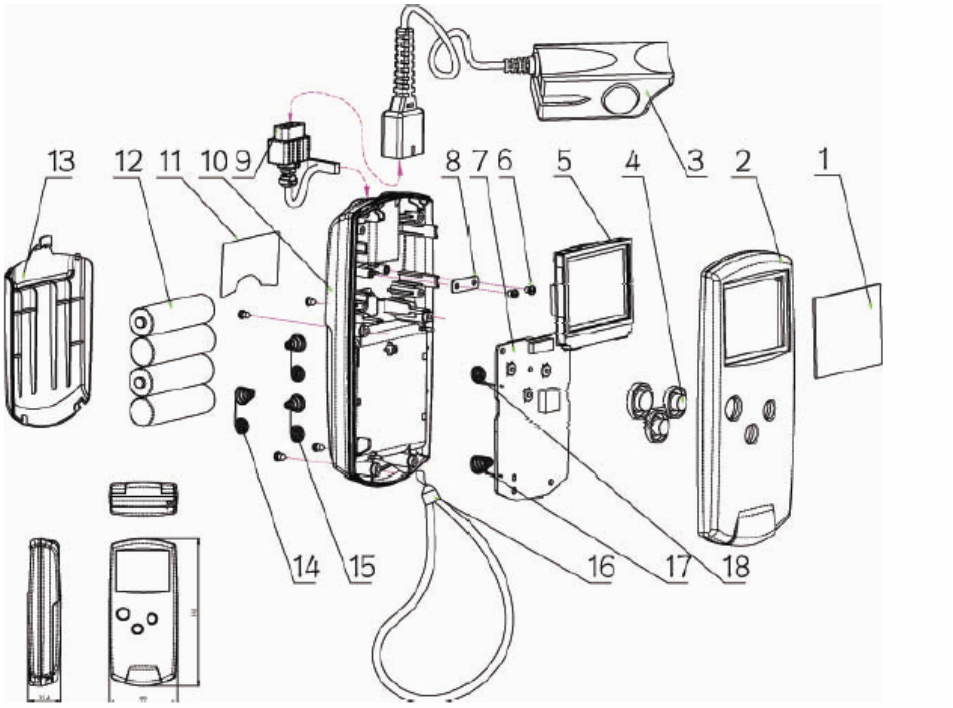

Fig 4-1 DPM1 Explosive diagram（115-001428-00）

Table 1 Parts list

#	P/N	Description	QTY
1	0850-20-30705	Screen cover	1
2	043-000085-00	Front housing	1
3	512F-30-28263	SpO2 sensor	1
4	0850-20-30703	Button	1
5	0850-10-30722	LCD module	1
6	M04-051060---	Panhead screws M2x8	
7	0850-30-30719	Main board	1
8	0850-20-30708	Socket fastening slide	1
9	0850-20-30704	SpO2/PC socket	1
10	0850-20-30701	Back housing	1

11	047-000194-00	Equipment label(English)	1
12	0000-10-10902	Battery	4
13	0850-20-30702	Battery cover	1
14	0850-20-30710	Electrode spring - B	1
15	0850-20-30709	Electrode spring - A	2
16	0000-10-11177	NECK STRAP	6
17	0850-20-30707	Cathode contact spring	1
18	0850-20-30706	Anode contact spring	1

4.2 Batteries Installation and Maintenance

4.2.1 Install Batteries

The DPM1 pulse oximeter is operated by four 1.5V AA batteries. Follow the steps below to install batteries before use:

1. Hold the DPM1 face-down firmly by one hand.
2. Push the battery cover gently by the other hand along the vertical direction of DPM1.
3. Take the battery cover off（as shown in Fig4-1）.
4. Insert the batteries in the slot per the electrode indications (as shown in Fig4-2).
5. Finally push back the battery cover.

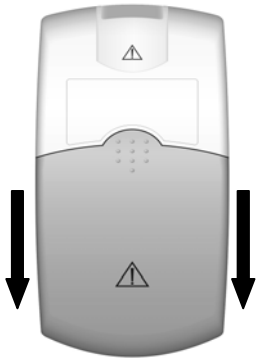

Fig 4-2 Battery assembly 1

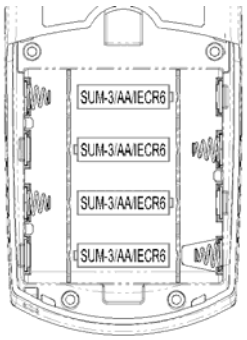

Fig 4-3 Battery Assembly 2

4.2.2 Battery Maintenance

1. Use the generic 1.5V AA alkaline battery or rechargeable battery, and do not use carbon battery or poor quality batteries. Remove the battery when nonuse for long time.
2. Replace the battery when the battery charge is insufficient for operation; abnormal power supply may lead to equipment damage or even personal injuries.

Notes：

1. The low battery symbol appears when the battery voltage is lower than 4.0V;
2. Shutdown will be executed automatically when the battery voltage is lower than 3.85V.

FOR YOUR NOTES

Chapter 5 Test and Prompt List

5.1 Test Procedure

5.1.1 Connection

Install batteries and connect a simulator with the DPM1. Turn on the power. LCD will display startup image and then the DPM1 enters the normal working mode.

5.1.2 Button Function Test

Press all the buttons one by one to inspect if the expected operation is executed promptly.

5.1.3 SpO2 Measurement Test

ID number display test: turn on the power and the ID number should blink for a few seconds. Then the ID number will change according to the operation of the ID conform button.

SpO2 measurement test: put the sensor on one figure and SpO2 value will appear on the screen shortly. Normal SpO2 value should be larger than 97%.

Pulse rate (PR) measurement test: check the PR value during SpO2 measurement;

Pulse strength bar test: check the pulse strength bar indication during SpO2 measurement under normal conditions as well as weak signal strength conditions.

5.1.4 Communication with PC

Connect the DPM1 with a PC (RS-232 port) by a cable. The data can be sent to PC.

5.2 Prompt List

Table 5-1 Prompt Information on LCD

Indications	Cause	Solution
Low battery symbol	The battery voltage is below the threshold value	Replace the battery
Memory full symbol	Available data memory locations ＜10	The existing data will be overwritten. Export the data in time.
Memory full symbol blinks	The memory is full	The existing data has been overwritten. Export the data in time.
ID full symbol	ID > 95	ID will be overwritten. Export the data in time.
ID full symbol blinks	ID has been overwritten	ID has been overwritten. Export the data in time.
Standby symbol	Standby mode	None
Communication symbol	Communication mode	None
DELETE ALL?	Delete button pushed	None
ALL DELETED	Delete button pushed again after “DELETE ALL?”	None

Table 5-2 Error indications

Error Message	Cause	Solution
Initiate Error	Failed self-test	Shut down the device (if can’t, remove the batteries) and contact Mindray DS for service.
Please Release the Button	Button error	Check for jammed button. If problem remains, contact Mindray DS for service.
Pulse Not Found Searching…	Pulse not found	Check the patient and alert the doctor.

Chapter 6 Maintenance and Cleaning

6.1 Maintenance

6.1.1 Unpacking and Inspection

1. Inspect the DPM1 for possible damage during shipment;
2. Check all the cables joint part and accessories;
3. Test all the functions applicable to the patients and assure the DPM1 in right states.

If the equipment shows any signs of malfunction, do not carry out any measurement on the patient and contact with the biomedicine engineer in the hospital or the Mindray DS service engineer immediately.

6.1.2 Routine Maintenance

A thorough examination shall be carried out every 6~12 months or after each maintenance by qualified personnel, including function and safety test.

Tests which need open the equipment should be done by qualified personnel. Safety and maintenance check can also be done by employee of Mindray DS. The local agency of Mindray DS would like to provide the materials related with the maintenance contract.

6.2 Cleaning

Make sure that the power is shut off before cleaning for the purpose of safety.

The equipment should be kept from dust. If the shell or screen needs cleaning, the detergent should be noncorrosive, such as soap or rinsing etc.

Notes：

1. **Do not use strong solvent, such as acetone.**
2. **Most cleanser need dissolving before use. Keep to the cleanser's instructions for use.**
3. **Do not use abrasive materials, such as fine steel wire or silver polishing agent.**
4. **Do not let any liquid ingress into the equipment and do not immerge the equipment into any liquid.**

5. **Keep the surface of the equipment clean after cleaning.**

Detergents

1. Diluted ammonia.
2. Diluted sodium hypochlorite（bleaching powder for washing）。
3. Diluted formaldehyde 35～37%.
4. Hydrogen peroxide 3%.
5. Ethanol.
6. Isopropano.

6.3 Disinfection & Sterilization

Disinfection:

Disinfection may damage the equipment, so, it is not advised to do unless necessary in the hospital's maintenance plan. Cleaning is recommended before disinfection. Recommended disinfecting agents include：ethylation and aldehyde。

⚠**Caution**⚠

1. **Dilute the solution per manufacturer instructions or use the solution as low as possible.**
2. **Do not let the liquid ingress into the equipment.**
3. **Do not let any part of the equipment immerged into the liquid.**
4. **Do not spill the liquid on the equipment.**
5. **Clean any residual solution immediately from the surface of the equipment with dry cloth.**

Sterilization:

Sterilization may damage the equipment, so, it is not advised to do unless necessary in the hospital's maintenance plan. Cleaning is recommended before sterilization. Refer to the Instructions for use for the sterilization of SpO2 sensor.

Do not use gas（EtO）or formaldehyde to sterilize the equipment.

6.4 Technical Support

Headquarter Custom Service

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Phone: 1.800.288.2121 1.201.995.8000 Fax: 1.800.926.4275

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